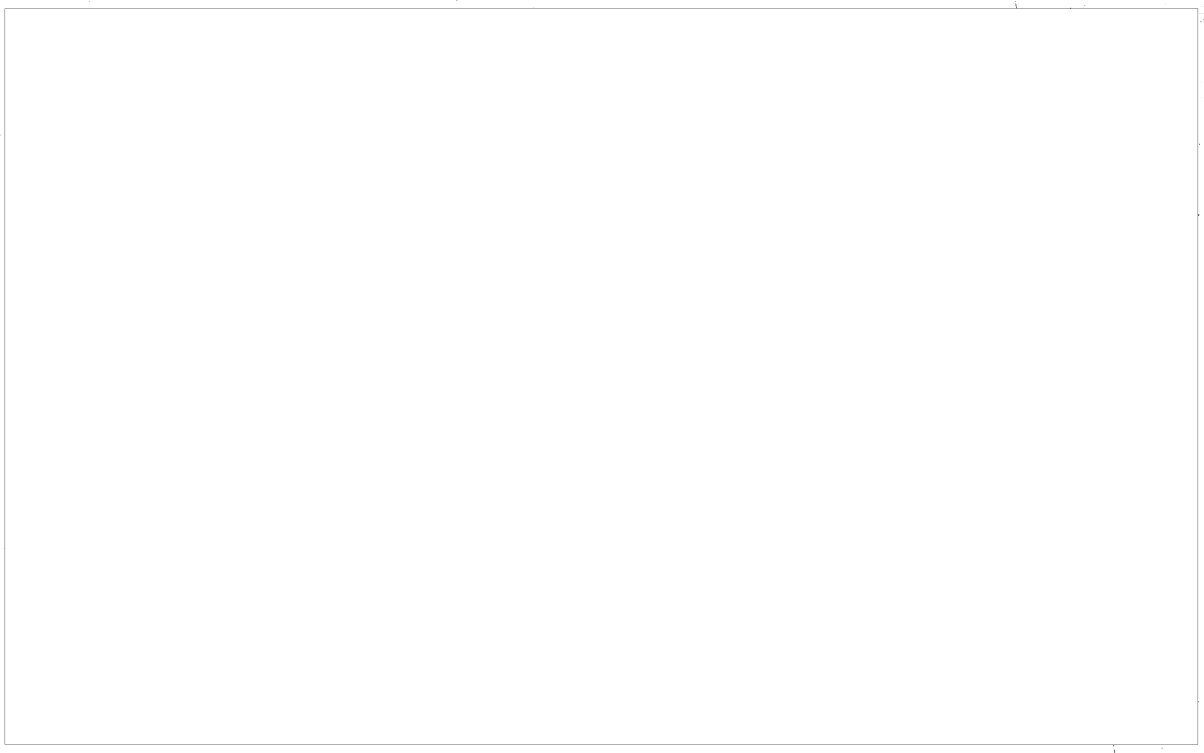
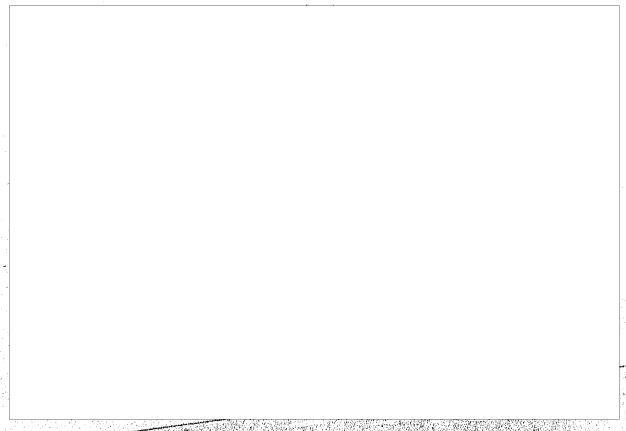


Introduction of VOM-2M Coal Combines

Mekhanizatsiya Trudoyemkikh i Tyazhelyak Rabot, No 9, pp 35-38, Russian Mo per, Sep 1951.



THE INTRODUCTION OF VOM-2m COAL-CUTTER COMBINES

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The Gorloka Machine-building Plant imeni S. M. Kirov completed the first batch of VOM-2m coal-cutter combines, the third and most recent modification of the VOM combine, in 1950. A number of operating features, which had already proved themselves in the testing of the original models, were incorporated into the new models, as follows:

(1) The utilization of the physical characteristics of the coal deposit in which, as a rule, the planes of stratification are parallel to the floor and the roof of the deposit (or close to being parallel), for the purpose of facilitating the breaking down of the coal. With one cutting device (the profile bar), the combine separates from the stope a vertical pack of coal, which is then easily disintegrated along the planes of stratification.

(2) The loading of the coal, which becomes easily disintegrated after its separation from the seam, with the aid of a simplified loading mechanism, on the style of a ploughshare. For coalescent coals, which do not disintegrate along the planes of stratification, an active cyclic, grizzly-type loader with a breaking device is provided.

The frame of the combine is set "up-edge", which allows for its placement on the same track with the scraper conveyor.

The peculiar feature of the VOM combine consists in its narrow grab. However, alongside this important defect, resulting in a

smaller amount of coal from one operating cycle, it offers a number of substantial advantages. These comprise the simplified design, the operation of the breaking device of the combine in the coal zone deformed by pressure of the surrounding rock, and the possibility of moving the conveyor without taking it apart.

The VOM-2m coal combine is designed for the mechanized extraction of coal and throwing it upon the conveyor in long clear-away stopes of shallow-dip seams, with an angle of dip up to 15 degrees, thickness of seam 1.3-2.5 meters, of medium and above-medium toughness, and is adapted to work in mine chambers with relatively weak roofs. The new model of the combine is distinguished from the old VOM model by the following:

(1) By irregularly-shaped cutting heads with greater telescopic adjustment.

(2) By a reinforced cutting element.

(3) By the presence of two interchangeable loading mechanisms -- ploughshare and loader.

(4) By a more powerful electric motor.

(5) By the presence of a special mine-chamber SK-20 scraper conveyor designed especially to operate jointly with the VOM-2m coal combine.

(6) By its low-mounted bar for cutting in seams beginning with a thickness of 1.3 meters.

The VOM-2m coal combine consists of five basic parts: (1)

the operating component -- a profile bar with a cutting chain; (2) the loading component of the ploughshare or the mechanical loader type; (3) the cutting chain drive, consisting of a motor gear reducer and the gar gear reducer; (4) the feeding mechanism (the feeding device of the high-power MV-60 cross-cutting machine with some modifications and additions); and (5) the MAD 191/11 electric motor of special design. In addition, there are auxiliary mechanisms -- a wedge-type clamp for the cable, a pulley, a tightening device, an attachment and tools.

The technical specifications of the VOM-2m are as follows:

Nominal depth of bite (meters)	1
The width of the incision gap (mm)	120-140
The extractable thickness of coal seam (meters)	1.3-2.3
Cutting chain speed (meters/second)	2
Cyclic loader chain speed (meters/second)	1.5
The advancing speed of the combine along the mine chamber (advance is cable-fed):	
Working advances (with the aid of pulley)	I - 0.135 II - 0.27 III - 0.405 IV - 0.54
Maneuvering advance (meters/minute)	14.5
Nominal hauling force at the drum (tons)	7

Diameter of haulage cable (mm)	15-18
Dable capacity of drum (meters)	25-40

Electric Motors	Main (MAD 191/11)	For Loader (Special)
Voltage	380	380
Hourly capacity, in kilowatts	65	23
RPM	1,465	--

Combine clearance dimensions in working position:	With ploughshare	With loader
Width of frame, in meters	0.47	0.47
Height of frame (meters)	0.93	0.93
Total length (meters)	5.0	4.8
Combine clearance dimensions in lowering:		
Width (meters)	0.47	0.47
Length (meters)	4.4	6.0
Weight of combine (depending on the weight of the cutting bar and the type of loader) (tons)		4-5

The coal-cutting combine is equipped with cutting bars of two types (normal-position and low-position) and cutting heads of five types, which adjustability provides for various values of extractable seam thickness, within the limits indicated in Table I below.

TABLE I

TABLE I

Type of cutting head	Head No	Extractable seam thickness (meters)	
		Cutting car in normal position	Cutting car in low position
Small irregular profile	I	1.7-1.85	--
Medium irregular profile	II	1.9-2.05	--
Large irregular profile	III	2.15-2.3	--
Semicircular	--	--	CB. 1.3
Irregular shape	IV	--	1.4-1.6

When at work, the frame of the coal-cutting combine is disposed along the stope and, as a rule, in the same passage with the conveyor. The width of the passage from the breast of the stope to the row of framing props is 1.1-1.2 meters.

When the VOM-2m combine works in conjunction with a cyclic loader, the setting up of the framing props between the combine and the conveyor is allowed, as an exception to the rule.

Since the feed element of the combine and the electric motor are set up-edge, the width of the combine frame is only 470 millimeters. Due to this position of the frame, the combine is more suitable for work with a cutting bar mounted on the left side in relation to its travel, i.e., for work in the left stope. In this case, the cable drum is nearest the breast of the stope, and the lid of the feeding mechanism and the feed mechanism itself are always accessible to inspection. The location of other assemblies allows for the use of the coal-cutting

combine with equal efficiency in both the left and the right stopes.

The coal fines are carried from the incision aperture by the cutting chain of the profile bar onto the conveyor, eliminating the necessity for a special loader of this material.

At mine shaft No 20-bis of the Molotov-Ugol' Trust of the Karaganda Coal Basin, a VOM-2m coal-cutter combine has been operating since January 1951 in the fourth west chamber of the bottom layer of the Verkhnyaya Marianna coal deposit. This coal deposit, at the western flank of the No 20-bis shaft, has a total thickness of 7.3 meters, and is divided by an interstratification of argillaceous shale from 0.4 to 1.8 meters thick into two packages. The thickness of the upper block of the coal deposit is about 3 meters; the thickness of the lower block is over 4 meters. At this flank of the shaft, the coal is mined in two layers -- first the upper layer, then, after a lag of 6-7 months, the lower layer comes into operation.

Figure I shows a section of the lower block of the coal deposit. During the work of the coal combine in January-April 1951, the working thickness of the bottom layer was 2.7 meters. A block of coal 1.6 meters in thickness constituted the pseudo-roofing of this working space. The basic roofing comprised disintegrated rock formations, which were formed following the extraction of the upper deposit layer. The floor in the mine chamber consisted of argillaceous shale. The coal is tough and sticky. The angle of dip of the deposit in the

mine chamber fluctuates within the range 20-10 degrees. The length of the mine chamber, over the period of operations of the coal combine, with which this article is concerned, was, on the average, 100 meters.

A mine chamber of such complex characteristics was selected on purpose to check the efficiency of the VOM-2m coal-cutter combine under the tough geological conditions of the Karaganda Coal Basin.

The coal combine, with the height of the cutting bar at 2.4 meters, is at work in the mine chamber, operating from the top downward and mechanizing the loading of coal to an extent of 80-85 percent. Coal packs remaining in the roof of the mine chamber are blasted out by drilling blast holes in the junction between the non-extracted coal pack and the breast of the stope and detonating the inserted explosives (100 grams per blast hole). With the detonation, the coal is separated simultaneously from the breast of the stope and from the roof, which process is helped along by the presence between the coal being freed by the explosion and the pseudo-roofing of an interlayer of argillaceous shale. The coal piled up by blasting is removed by hand-picking.

The mined-out space in the wake of the advancing coal-cutter combine is braced with built-up timber frames consisting of three sawed-to-size props (2.2 meters long) which are set along the run of the coal seam. The adjacent timber frames along the dip of the coal seam (perpendicular to the stope) are placed in a checkerboard pattern in steps of 0.9 meter. The shoring is

framed in the wake of the combine in the following order. As the coal combine makes the current extraction pass, timber frames are placed on two props separated by a 1.8-meter step along the dip of the coal seam. One prop is set to support a timber placed overhead at the loading end of the conveyor, the second prop -- to support an overhead timber in front of the conveyor -- at the breast of the stope. Simultaneously, a third prop is forced under the overhead timbers along the roof over the track, along which the conveyor and the coal combine are disposed. After the timber-framing is set in place, there is a new unencumbered track 1.2 meters wide (from the breast of the stope) for the conveyor and coal combine to operate in. The remainder of the mined-out space is reinforced with timber frames, each frame consisting of three props and one overhead roof-reinforcing timber (the center distance between the proprs is 0.9 meter).

The diagram for the timber-framing of the mine chamber is shown in Figure 2.

The control of the roof over the mine chamber is effected by the method of complete step-by-step cave-ins, the step being equal to 3.6 meters, i.e., the width of four coal-cutting combine passes. In order to cave in the roof of the mine chamber, a through blast hole is perforated.

The coal is fed from the mine chamber by three conveyors (Figure 3): an SK-20 conveyor along the mine chamber, an STR-30 conveyor along the bottom cross-cut, and an SKR-11 conveyor along the dryer. The height of the flanged edges of the SKR-11 conveyor is increased by welding on steel strips. The loading of

coal on the conveyor is effected by a ploughshare-type loader. Due to the pastiness of the coal, excessively large lumps come off the ploughshare loader. In order to reduce the size of the coal lumps, percussion blasting of the stope is resorted to. Blast holes 0.9 meter deep, perpendicular to the plane of the stope (Figure 4) are drilled in a checkerboard pattern, with 150 grams of explosive packed into each blast hole.

The mine chamber, in which the coal-cutter combine is operating, works two shifts, as far as the extraction of coal is concerned. The third shift is for maintenance and set-up. Table 2 below cites some technical and economic indexes over a 2-month period of the coal-cutter combine operation -- March and April 1951 -- and also the mean data for a 2-month operation of the mine chamber (November and December 1950), prior to the introduction of the coal-cutter combine.

TABLE 2

Index	1951		Mean Data for Mine Chamber	
	March	April	March and April 1951	November and December 1950
Monthly extraction of coal, in tons	7,379	7,321	7,345	5,442
Mean productivity per miner, extracted per section, in tons	4.27	4.32	4.3	3.82

The Table above shows that the introduction of the VOM-2m

coal-cutter combine raised the extraction of coal from the mine chamber 1,900 tons per month, or 35 percent, and raised the productivity per miner per section 0.5 ton, or 13 percent. The extraction cost per ton per section was reduced 7 percent.

During certain well-organized shifts, the coal-cutter combine passed 200 tons of coal.

On 11 and 12 January 1951, the work of the coal-cutter combine was checked chronometrically. On 11 January the time observations were made during the first shift. The purely mechanical work of the combine amounted to 3 hours 15 minutes; the combine gained a headway of 70 meters, and passed 219 tons of coal. The productivity per miner per section in coal extracted was 12.1 tons. The next day -- 12 January -- the first shift was time-studied again. The purely mechanical work of the combine amounted to 2 hours 39 minutes. The combine gained 40 meters of mine-chamber headway, and passed 182 tons of coal. Productivity per miner per section in coal extracted was 9.6 tons. In totaling the results of these two shifts in terms of time, the purely mechanical work of the combine amounted to 36.5 percent. Technologically unavoidable interruptions amounted to 15.4 percent. Set-up and finish operations amounted to 6.9 percent. Avoidable interruptions accounted for 41.2 percent. The high percentage of time falling to avoidable interruptions indicates that the utilization of the VOM-2m coal-cutter combine in this mine chamber is amenable to further improvement.

The highest indexes for the operation of the coal combine were obtained in the first 10 days of April, with 2,860 tons of

coal extracted. Hence, it is clear that, with the proper organization of work in the mine chamber, the extraction of coal may be brought up to 8,500-9,000 tons per month.

In May 1951, the coal-cutter combine was working with its cutting bar set at a height of 3 meters. In order to operate at such a bar set-up, the power of the electric motor had to be increased. This was attained by connecting the shafts of two electric motors, disposed along the same axis. In contradistinction to such motor-connecting systems, which were previously used at the suggestions of Engineer N. I. Sikov, separate feeding and separate starting were used in this case, which method tends to improve considerably the electric system and motor operation. The additional electric motor lengthens the combine by 1.2 meters, but does not lower its operational indexes.

The operation of the VOM-2m coal-cutter combine with the cutting bar set at 3 meters, and with two electric motors, revealed the possibility of utilizing the machine for one-layer extraction of anthracite deposits more than 3 meters in thickness.

In 2-layer extraction with the VOM-2m combine at a 3-meter cutting bar set-up the losses of coal in the mine chamber should be reduced approximately 10 percent, due to the increase in the extractable thickness.

In analyzing the possibilities of further introduction of the VOM-2m coal-cutter combine in connection with the experience in its use gained in the Karaganda Coal Basin where coal deposits of great thickness are worked by two- and three-

layer extraction, the conclusion can be drawn that this machine is fully suitable. It makes the mechanization of coal-loading in the mine chamber possible during the extraction of the second and third layers of the deposit, providing metal netting is used as artificial roofing.

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